Real time online matching in high dose per fraction treatments:

Do radiation therapists perform as well as physicians?

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Introduction

For high dose per fraction treatments such as stereotactic body radiotherapy (SBRT) we require a physician to perform the pre-treatment on board imaging (OBI) match. The purpose of this study was to determine if patient matching positioning by radiation therapists (RTTs) is as accurate as physician matching.

Objectives

1. Recognition of the RTT's ability for positioning matching using OBI in high dose treatments.
2. Ensuring greater accuracy with OBI match by certified RTTs for pre-positioning as a base line for physician match for high dose treatments.
3. Optimizing treatment time by first having RTTs perform OBI positioning while the physician is on his or her way to the console, and then corrections and final approval of the physician just before the treatment.

Materials and Methods

16 RTTs and 5 physicians participated in this study. Data were collected from 72 patients totaling 202 measurements. 41 patients were treated for bone lesions, and 31 were treated for soft tissue lesions such as lung, pancreas etc. Online matches were performed using kV-kV imaging for bones, and cone beam CT (CBCT) for soft tissue. All treatments were delivered on a Varian linear accelerator (Palo Alto, CA). The initial match was performed by the RTTs and the shifts noted. The match was then reset, and the physician performed an independent match without prior knowledge of the RTTs match. Physician shifts were noted, and applied to the patient for treatment.

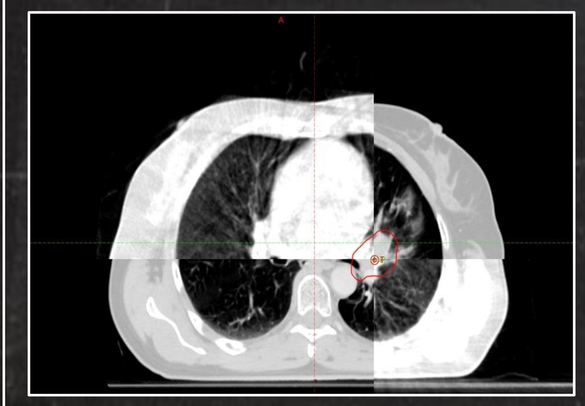

Figure1: Example of CBCT soft tissue match

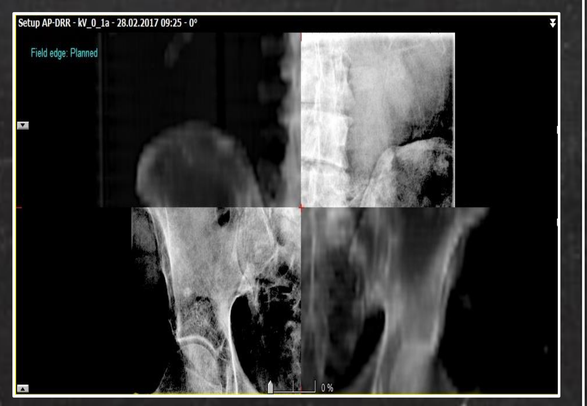

Figure 2: Example of kV-kV bony match

Results

The average vector shift was 0.84±0.58 cm vs. 0.88±0.59 cm for RTTs and physician respectively. We also calculated the shifts in the lateral, vertical, longitudinal and rotational direction respectively, which were as follows: -0.01±0.45 cm vs. -0.01±0.46 cm; 0.07±0.65 cm vs. 0.04±0.65 cm; -0.17±0.63 cm vs. -0.19±0.69 cm; -0.14±1.2 degrees vs. –0.04±1.25 degrees for RTT and physician respectively.
The Mann-Whitney rank sum test showed that all shifts were not statistically significantly different ($p>0.2$). Breaking down the matches to bony or soft tissue matches did not yield any significant differences either.

Figures 3 and 4 show the physician vs. RTT vector shifts for soft tissue (CBCT) and bony anatomy matches (kV-kV) respectively. It can be clearly seen that the matches are very similar. Specifically, in the bony anatomy matches even for the outliers, where patients had large shifts, the physician and RTT shifts were similar.

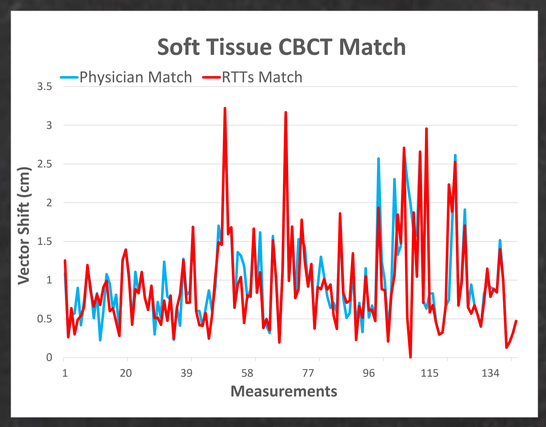

Figure 3: Physician vs. RTT CBCT soft tissue match

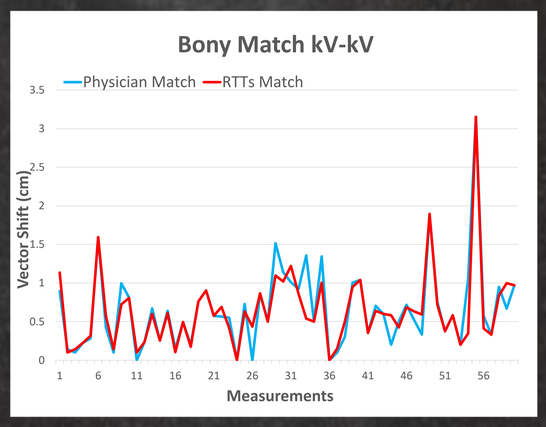

Figure 4: Physician vs. RTT kV-kV bony match

Conclusions

RTT matches proved to be as accurate as physician matches for both bony anatomy and soft tissue lesions, using kV-kV and CBCT on board imaging modalities. While the demand for physician presence at the machine during a high dose treatment may stem from a medico-legal rationale, based on our results RTTs are as qualified as the physicians to perform an accurate match. Thus, it may be feasible to allow the RTTs to perform the match, and have the physician review it off-line without having to disrupt their schedule and be present at the machine during treatment. This can be done without compromising patient safety or quality of treatment when the RTT team is well-trained.

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